

### REMARKS

Upon entry of this response, claims 7-17 and 22-34 are pending. Claims 1-8 and 18-21 have been canceled. Claims 7-10 have been amended. No new matter has been added by way of this response.

Support for the amendment to claim 7 appears at least at claims 1 and 7. Support for the amendment to claim 8 appears at least at claim 8 and ¶0080. Support for the amendment to claim 9 appears at least at claim 9. Support for the amendment to claim 10 appears at least at claim 10 and ¶0080.

Support for new claim 22 appears at least at claims 2 and 7. Support for new claim 23 appears at least at claims 3 and 7. Support for new claim 24 appears at least at claims 4 and 7. Support for new claim 25 appears at least at claims 4, 7 and ¶0052. Support for new claim 26 appears at least at claims 4 and 7. Support for new claims 27 and 28 appears at least at formula (1), formula (2), formula (3), and formula (4). Support for new claims 29-31 appears at least at ¶0054. Support for new claims 32-33 appears at least at claims 6 and 7. Support for new claim 34 appears at least at claims 6, 7, 10, 12, 13, 14, 15, 16, ¶0079, ¶0080, and figure 1.

### **Restrictions Required**

In the Official Action, the Office required an election of one of the following invention under 35 U.S.C. 121:

Group I: Claim 1, drawn to functional derivatives of a quinone molecule, non-classifiable due to the lack of a complete structure of the molecule.

Claims 2-6 to be examined with this invention.

Group II: Claims 7-17, drawn to an electrode comprising a mediator according to any one of claims 1-6 which claims are considered to be improper multiple dependencies, cannot be properly classified.

Group III: Claims 18-20, drawn to biofuel cell which includes an enzyme, a fuel substrate (fuel), and electrodes comprising a cathode and an anode according to claim 7

for the electrodes which claims are improper due to the multiple dependencies  
and a proper classification cannot be made due to the lack of a generic structure.

Group IV: Claim 21, drawn to a compound, classified in class 552, subclass 299.

In the Official Action, the Office further required an election of one of the following  
species:

A: A molecule comprising a quinone derivative:

Aa. Which is a naphthoquinone derivative;

Whereby the derivative is:

i. is one or more kinds of a naphthoquinone molecule chosen from  
the group consisting of

ia. a sodium anthraquinone-2-sulfonate (AQS) derivative;

ib. a 2-methyl-1,4-naphthoquinone (VK.sub.3) derivative.

Xba > is a 2-methyl-1,4-naphthoquinone (VK.sub.3)  
derivative.

Whereby above Xba derivative is selected from the  
following functional groups:

Xa> amino group,

Xb> a carboxyl group,

Xc> a chloroformyl group,

Xd> a succinimide oxycarbonyl group,

Xe> an alkyl metal sulfosuccinimide oxycarbonyl  
group,

Xf> a pentafluorophenyl oxycarbonyl group,

Xg> a p-nitrophenyl oxycarbonyl group,

Xh> a hydroxyl group,

Xi> a formyl group,

Xj> a halogen group,

Xk> a maleimide group,

Xm> an isothiocyanate group,

Xn> an oxiranyl group, or

Xp> more than one functional group - please specify.

Further whereby the 2-methyl-1,4-naphthoquinone (VK.sub.3) derivative is one or more kinds of a quinone molecule selected from the group consisting of:

AA1: 2-(3-carboxypropyl)-3-methyl-1,4-naphthoquinone (CPVK.sub.3) represented by the following formula (1),

AA2: 2-3-[N-(2-aminoethyl)aminocarbonyl]propyl)-3-methyl-1,4-naphthoquinone (AEACPVK.sub.3) represented by the following formula (2),

AA3: 2-(3-aminopropyl)-3-methyl-1,4-naphthoquinone (APVK.sub.3) represented by the following formula (3),

Ab. Which is any other quinone derivative - please specify.

B: Whereby the enzyme is

- a. not immobilized;
- b. immobilized.

C. Whereby the enzyme contains:

- x. diaphorase;
  - y. diaphorase and dehydrogenase.
- D. Whereby the electrode of above Cx or Cy comprises:
  - a. further comprising NADH immobilized;
  - b. does not further comprise NADH immobilized.
- E. Whereby an electrode comprising an enzyme immobilized comprising the mediator:
  - m. comprising an enzyme immobilized on the electrode by a polymer and a crosslinking agent;
  - n. comprising an enzyme immobilized on the electrode by only a polymer.
- F. Whereby the polymer is:
  - p. polyvinylimidazole;
  - q. other polymer - please specify.
- G. Whereby the crosslinking agent is:
  - i. polyethylene glycol diglycidyl ether;
  - ii. other - please specify.
- H. Whereby the electrode contains:
  - o. an oxygen separation membrane;
  - p. no oxygen separation membrane.

### **Elections and Provisional Elections**

In response to the Office's invention restriction requirement, Applicants elect to prosecute the invention of Group II, encompassing claims 7-17, drawn to an electrode comprising a mediator.

In electing the species referenced below, Applicants hereby request REJOINER (see MPEP § 821.04) of all non-elected species claims upon allowance of a generic claim.

In response to the Office's species restriction of A(a-b), Applicants elect species A(a), which is a naphthoquinone derivative. Claims 22-34 are readable on the A(a) elected species.

It is noted that the Office failed to provide alternative species at an A(a)(i) level.

In response to the Office's sub-species restriction of A(a)(i)(a-b), Applicants elect species A(a)(i)(b), which is a 2-methyl-1,4-naphthoquinone (VK3) derivative. Claims 23-34 are readable on the A(a)(i)(b) elected sub-species.

In response to the Office's sub-sub-species restriction of A(a)(i)(b)(Xa-Xp), Applicants *provisionally elect, with traverse*, species A(a)(i)(b)(Xb), which is a 2-methyl-1,4-naphthoquinone (VK3) derivative modified with a carboxyl functional group capable of bonding with a polymer or enzyme. Claims 26-34 are readable on the A(a)(i)(b)(Xb) elected sub-sub-species.

In response to the Office's sub-sub-sub-species restriction of A(a)(i)(b)(X)(AA1-AA3), Applicants *provisionally elect, with traverse*, species A(a)(i)(b)(X)(AA1), which is 2-(3-carboxypropyl)-3-methyl-1,4-naphthoquinone (CPVK3), represented by formula (1) in the specification. Claims 32-34 are readable on the A(a)(i)(b)(X)(AA1) elected sub-sub-sub-species.

In response to the Office's species restriction B(a-b), Applicants elect species B(b), which is an immobilized enzyme. Claims 8-15 and 34 are readable on the B(b) elected species.

In response to the Office's species restriction C(x-y), Applicants elect species C(y), which is diaphorase and dehydrogenase. Claims 10-12 and 34 are readable on the C(y) elected species.

In response to the Office's species restriction D(a-b), Applicants elect species D(a), which is further comprising NADH immobilized. Claims 12 and 34 are readable on the D(a) elected species.

In response to the Office's species restriction E(m-n), Applicants elect species E(m), which is comprising the mediator and the enzyme immobilized on the electrode by a polymer and a crosslinking agent. Claims 13 and 34 are readable on the E(m) elected species.

In response to the Office's species restriction F(p-q), Applicants elect species F(p), which is polyvinylimidazole. Claims 14 and 34 are readable on the F(p) elected species.

In response to the Office's species restriction G(i-ii), Applicants elect species G(i), which is polyethylene glycol diglycidyl ether. Claims 15 and 34 are readable on the G(i) elected species.

In response to the Office's species restriction H(o-p), Applicants elect species H(o), which is an oxygen separation membrane. Claims 16 and 34 are readable on the H(o) elected species.

### **Traversal of Species Restriction Requirement**

Applicants traverse the above referenced sub-sub-species restriction of A(a)(i)(b)(Xa-Xp) and the sub-sub-sub-species restriction of A(a)(i)(b)(X)(AA1-AA3). For any restriction requirement to be proper, the Office must show there would be a serious burden on it if such restriction were not required, MPEP § 803, § 808, and this can only be established by showing (A) a separate classification, (B) a separate status in the art when inventions are classifiable together, or (C) a different field of search. MPEP §§ 803 and 808.02. In this case, the Office has only alluded to reasons why it believes the species to be patentably distinct. But the Office has failed to address, through any one of the above required showings, why not requiring the species restriction would result in a serious burden, and thus, has failed to comply with its administrative burden to do so.

The present invention is directed to an electrode that includes an immobilized electron mediator, useful, for example, in a biofuel cell (see ¶0003). The immobilized electron mediator can be a 2-methyl-1,4-naphthoquinone (VK3) derivative. The 2-methyl-1,4-naphthoquinone derivative backbone can be modified, preferably at the 2- and/or 3-position of the naphthoquinone, so as to have a functional group that is capable of bonding with a polymer or an enzyme. Various compounds with such functional group modification are described in, for example, ¶0107-0116 and include CPVK3, AEACPVK3, and APVK3.

Separate Classification: For the Office to show separate classification, each restricted entity must have attained recognition in the art as a separate subject for inventive effort, and also a separate field of search. MPEP § 808.02(A).

Here, the inventive effort surrounding each of the A(a)(i)(b)(Xa-Xp) sub-sub-species was similar. As to development of embodiments of electrodes comprising immobilized mediators that include 2-methyl-1,4-naphthoquinone (VK3) derivatives modified with at least one functional

group capable of bonding with a polymer or an enzyme (i.e., the A(a)(i)(b)(Xa-Xp) sub-sub-species), the efforts to develop such embodiments would not be recognized as separate efforts in the electro-biofuel cell arts—And despite its administrative burden to do so, the Office has failed to show otherwise. Further, a search for electrodes comprising immobilized mediators that include 2-methyl-1,4-naphthoquinone (VK3) derivatives modified with at least one functional group capable of bonding with a polymer or an enzyme will necessarily involve 2-methyl-1,4-naphthoquinone (VK3) derivatives with the Xa-Xp species functional groups present. As such, there is not sufficient separate classification to support the A(a)(i)(b)(Xa-Xp) sub-sub-species restriction requirement.

And the inventive effort surrounding each of the A(a)(i)(b)(X)(AA1-AA3) sub-sub-sub-species was similar. As to development of embodiments of electrodes comprising immobilized mediators that include CPVK3, AEACPVK3, and/or APVK3, the efforts to develop such embodiments would not be recognized as separate efforts in the electro-biofuel cell arts—And despite its administrative burden to do so, the Office has failed to show otherwise. Each A(a)(i)(b)(X)(AA1-AA3) embodiment listed above includes a 2-methyl-1,4-naphthoquinone (VK3) derivative with a methyl at the 3-position and modified by at least one carboxyl group or amino group at the 2-position so as to be capable of polymer- or enzyme-bonding. Further, a search for electrodes comprising immobilized mediators that include 2-methyl-1,4-naphthoquinone (VK3) derivatives with a methyl at the 3-position and modified by at least one carboxyl group or amino group at the 2-position so as to be capable of polymer- or enzyme-bonding will necessarily include CPVK3, AEACPVK3, and APVK3.

Separate status in the art when inventions classifiable together: For the Office to show separate status in the art where inventions are classifiable together, each invention must have formed a separate subject for inventive effort as illustrated by a recognition of separate inventive effort by inventors. MPEP § 808.02(B). Separate status in the art can be shown by citing patents which are evidence of such separate status, and also of a separate field of search. MPEP § 808.02(B).

In this case, the Office has failed to cite patents demonstrating separate status and also separate field of search. Further, the inventive effort directed toward development of embodiments of electrodes comprising immobilized mediators that include 2-methyl-1,4-naphthoquinone (VK3) derivatives modified with at least one functional group capable of bonding with a polymer or an enzyme (i.e., the A(a)(i)(b)(Xa-Xp) sub-sub-species) was similar,

as explained above. Likewise, the inventive effort directed toward development of embodiments of electrodes comprising immobilized mediators that include CPVK3, AEACPVK3, and/or APVK3 (i.e., the A(a)(i)(b)(X)(AA1-AA3 sub-sub-sub-species) was similar, as explained above.

As such, there is not sufficient separate status in the art to support the A(a)(i)(b)(Xa-Xp) sub-sub-species restriction requirement or the A(a)(i)(b)(X)(AA1-AA3) sub-sub-sub-species restriction requirement, respectively.

A different field of search: For the Office to show a different field of search, it must be necessary to search for one of the restricted entities in a manner that is not likely to result in finding art pertinent to the other restricted entities (s) (e.g., searching different classes/subclasses or electronic resources, or employing different search queries). MPEP § 808.02(C). The indicated different field of search must in fact be pertinent to the type of subject matter covered by the claims. *Id.* In this case, searching for electrodes comprising immobilized mediators that include 2-methyl-1,4-naphthoquinone (VK3) derivatives modified with at least one functional group capable of bonding with a polymer or an enzyme will necessarily involve finding art pertinent to said backbone with, for example, amino group, a carboxyl group, a chloroformyl group, a succinimide oxycarbonyl group, an alkyl metal sulfosuccinimide oxycarbonyl group, a pentafluorophenyl oxycarbonyl group, a p-nitrophenyl oxycarbonyl group, a hydroxyl group, a formyl group, a halogen group, a maleimide group, an isothiocyanate group, and/or an oxiranyl group. Similarly, searching for electrodes comprising immobilized mediators that include 2-methyl-1,4-naphthoquinone (VK3) derivatives modified with at least one functional group capable of bonding with a polymer or an enzyme will likely involve finding art pertinent to, for example, CPVK3, AEACPVK3, and APVK3. The Office should not have to search different classes, electronic resources, or employ different search queries. As such, there is not sufficient difference in the field of search to support the restriction requirement.

For the above reasons, Applicants assert the presently traversed species restriction requirements are not proper and respectfully requests the Office to withdraw the required elections.



# CONCLUSION

Applicants believe that the claim as presented represents allowable subject matter. If the Examiner desires, Applicants welcome a telephone interview to expedite prosecution. As always, the Examiner is free to call the undersigned at the number below. Applicants believe there is a \$2,160.00 extension fee for response made in the fifth month due at this time. However, the Commissioner is hereby authorized to charge any applicable fees to Deposit Account No. 19-3140.

Respectfully submitted,

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